

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1 1-11 (Canceled).

1 12. (Original Claim) A computer-readable storage medium storing
2 instructions that when executed by a computer cause the computer to perform a
3 method for using a computer system to solve a global optimization problem
4 specified by a function f and a set of equality constraints, the method comprising:
5 receiving a representation of the function f and the set of equality
6 constraints $q_i(\mathbf{x}) = 0$ ($i=1, \dots, r$) at the computer system, wherein f is a scalar
7 function of a vector $\mathbf{x} = (x_1, x_2, x_3, \dots x_n)$;
8 storing the representation in a memory within the computer system;
9 performing an interval equality constrained global optimization process to
10 compute guaranteed bounds on a globally minimum value of the function $f(\mathbf{x})$
11 subject to the set of equality constraints;
12 wherein performing the interval equality constrained global optimization
13 process involves,
14 applying term consistency to a set of relations associated
15 with the interval equality constrained global optimization problem
16 over a subbox \mathbf{X} , and excluding any portion of the subbox \mathbf{X} that
17 violates any of these relations,
18 applying box consistency to the set of relations associated
19 with the interval equality constrained global optimization problem

20 over the subbox **X**, and excluding any portion of the subbox **X** that
21 violates any of the relations, and
22 performing an interval Newton step for the interval
23 equality constrained global optimization problem over the subbox
24 **X**.

1 13. (Original Claim) The computer-readable storage medium of claim 12,
2 wherein applying term consistency to the set of relations involves applying term
3 consistency to the set of equality constraints $q_i(\mathbf{x}) = 0$ ($i=1, \dots, r$) over the subbox
4 **X**.

1 14. (Original Claim) The computer-readable storage medium of claim 12,
2 wherein applying box consistency to the set of relations involves applying box
3 consistency to the set of equality constraints $q_i(\mathbf{x}) = 0$ ($i=1, \dots, r$) over the subbox
4 **X**.

1 15. (Original Claim) The computer-readable storage medium of claim 12,
2 wherein performing the interval equality constrained global optimization
3 process involves,

4 keeping track of a least upper bound f_{bar} of the function
5 $f(\mathbf{x})$, and

6 removing from consideration any subbox for which
7 $\inf(f(\mathbf{X})) > f_{\text{bar}}$;

8 wherein applying term consistency to the set of relations involves applying
9 term consistency to the f_{bar} inequality $f(\mathbf{x}) \leq f_{\text{bar}}$ over the subbox **X**.

1 16. (Original Claim) The computer-readable storage medium of claim 15,
2 wherein applying box consistency to the set of relations involves applying box
3 consistency to the $f_{\bar{b}ar}$ inequality $f(\mathbf{x}) \leq f_{\bar{b}ar}$ over the subbox \mathbf{X} .

1 17. (Original Claim) The computer-readable storage medium of claim 12,
2 wherein performing the interval equality constrained global optimization
3 process involves preconditioning the set of equality constraints through
4 multiplication by an approximate inverse matrix \mathbf{B} to produce a set of
5 preconditioned equality constraints; and
6 wherein applying term consistency to the set of relations involves applying
7 term consistency to the set of preconditioned equality constraints over the subbox
8 \mathbf{X} .

1 18. (Original Claim) The computer-readable storage medium of claim 17,
2 wherein applying box consistency to the set of relations involves applying box
3 consistency to the set of preconditioned equality constraints over the subbox \mathbf{X} .

1 19. (Original Claim) The computer-readable storage medium of claim 12,
2 wherein performing the interval Newton step involves performing the interval
3 Newton step on the John conditions.

1 20. (Original Claim) The computer-readable storage medium of claim 12,
2 wherein prior to performing the interval Newton step on the John conditions, the
3 method further comprises performing a linearization test to determine whether to
4 perform the Newton step on the John conditions.

1 21. (Original Claim) The computer-readable storage medium of claim 12,
2 wherein performing the interval equality constrained global optimization process
3 involves:

4 evaluating a first termination condition;

5 wherein the first termination condition is TRUE if the width of the subbox
6 \mathbf{X} is less than a pre-specified value, ε_X , and the width of the $f(\mathbf{X})$ is less than a pre-
7 specified value, ε_F ; and

8 if the first termination condition is TRUE, terminating further splitting of
9 the subbox \mathbf{X} .

1 22. (Original Claim) The computer-readable storage medium of claim 12,
2 wherein performing the interval Newton step involves:

3 computing $\mathbf{J}(\mathbf{x}, \mathbf{X})$, wherein $\mathbf{J}(\mathbf{x}, \mathbf{X})$ is the Jacobian of the function \mathbf{f}
4 evaluated as a function of \mathbf{x} over the subbox \mathbf{X} ; and

5 determining if $\mathbf{J}(\mathbf{x}, \mathbf{X})$ is regular as a byproduct of solving for the subbox \mathbf{Y}
6 that contains values of \mathbf{y} that satisfy $\mathbf{M}(\mathbf{x}, \mathbf{X})(\mathbf{y} - \mathbf{x}) = \mathbf{r}(\mathbf{x})$, where
7 $\mathbf{M}(\mathbf{x}, \mathbf{X}) = \mathbf{B}\mathbf{J}(\mathbf{x}, \mathbf{X})$, $\mathbf{r}(\mathbf{x}) = -\mathbf{B}\mathbf{f}(\mathbf{x})$, and \mathbf{B} is an approximate inverse of the center of
8 $\mathbf{J}(\mathbf{x}, \mathbf{X})$.

1 23-33 (Canceled).